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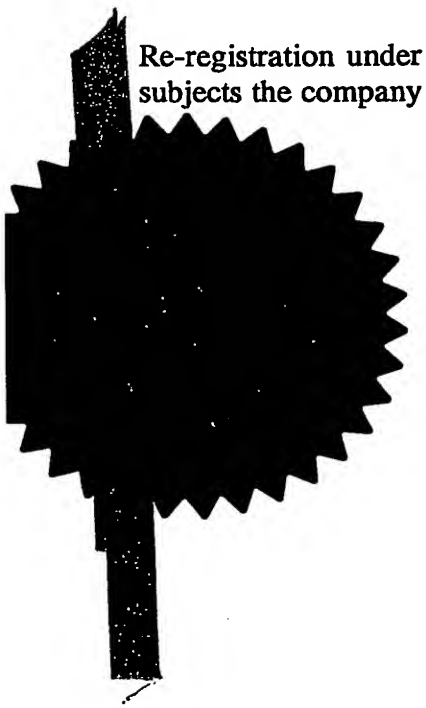

Signed Stephen Hordley.

Dated 24 November 2003

An Executive

Patents Form 1/77

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Request for grant of a patent

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1. Your reference — P16907GB - LDH/ALM/szl

2. Patent application number
(The Patent Office will fill in this part) — 0 8 NOV 2002

11NOV02 E762205-7 000389
P01/7700 0.00-0226126.1

3. Full name, address and postcode of the or of each applicant *(underline all surnames)*

NMI Safety Systems Limited
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London N17 0YX

0226126.1

Patents ADP number *(if you know it)*

6783633002

If the applicant is a corporate body, give the country/state of its incorporation — United Kingdom

4. Title of the invention — A Restraint

5. Name of your agent *(if you have one)*

Forrester Ketley & Co.

"Address for service" in the United Kingdom to which all correspondence should be sent *(including the postcode)*

Forrester House
52 Bounds Green Road
London
N11 2EY

Patents ADP number *(if you know it)* — 133001

6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and *(if you know it)* the or each application number

Country	Priority application number *(if you know it)*	Date of filing *(day / month / year)*

7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application

Number of earlier application	Date of filing *(day / month / year)*

8. Is a statement of inventorship and of right to grant of a patent required in support of this request? *(Answer 'Yes' if:*

a) any applicant named in part 3 is not an inventor, or
b) there is an inventor who is not named as an applicant, or
c) any named applicant is a corporate body.
See note (d))

YES

Patents Form 1/77

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Continuation sheets of this form	-
Description	28
Claim *(s)*	5
Abstract	1
Drawing *(s)*	14 +14

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Priority documents	-
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Statement of inventorship and right to grant of a patent *(Patents Form 7/77)*	Yes - 2
Request for preliminary examination and search *(Patents Form 9/77)*	-
Request for substantive examination *(Patents Form 10/77)*	-
Any other documents *(please specify)*	-

11. I/We request the grant of a patent on the basis of this application.

Forrester Ketley & Co.
Signature

Date
8 November, 2002

Forrester Ketley & Co.

12. Name and daytime telephone number of person to contact in the United Kingdom

Lloyd D. HOARTON (020) 8889 6622

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PATENTS ACT 1977

P16907GB - ALM/szl

A RESTRAINT

THE PRESENT INVENTION relates to a wheelchair restraint system and more particularly, relates to a wheelchair restraint system intended for use in a vehicle.

There is a requirement for a wheelchair restraint system which may be used in a vehicle to provide protection for the occupant of a wheelchair within the vehicle. Various prior proposals have been made concerning the provision of such restraints, but such proposals either use anchoring points which are mounted to the body of the vehicle, meaning that wheelchairs can only be located in vehicles at positions immediately adjacent these anchoring points, or the arrangements are in the form of restraint mechanisms that can be connected to rails mounted in the floor of the motor vehicle necessitating, in many cases, the removal of a seat from the vehicle to enable the restraint mechanism and the wheelchair to be restrained to be located in place.

Further, other wheelchair restraint systems use a track or tracks fitted to the floor of the vehicle. The restraint system is slidably mounted on the track. Wheelchair restraints are usually provided at the rear of a vehicle where large double doors can be opened to allow access, usually facilitated by a tailgate lift. The restraint system, in the form of a seat back, is detached from the track and slid out of the back of

the vehicle to allow the wheelchair and occupant to be located in the vehicle. The restraint system must then be remounted on the track, correctly installed and then the wheelchair restrained against the seat back. The removal of the restraint system from the vehicle to allow the wheelchair into the vehicle and the subsequent replacement of the restraint system is an awkward and time-consuming task.

The present invention seeks to provide a wheelchair restraint system which does not necessitate removal of elements of the restraint system from the vehicle to allow wheelchair access to the vehicle prior to restraint.

Accordingly, one aspect of the present invention provides a restraint for restraining an item in a vehicle, the restraint comprising a support structure to be mounted on the floor of the vehicle, the support structure carrying a removable seat squab, a seat-back which is provided with a safety-belt arrangement and a securing arrangement to engage the item to be restrained, the support structure being mounted on the floor of the vehicle by a rotatable base having a restraint configuration in which the support structure is in a position to receive and restrain the item and an access configuration in which the support structure is rotated from the restraint configuration to improve access to the vehicle.

Preferably, the support structure is rotatable through substantially 90° between the restraint configuration and the access configuration.

Conveniently, the support structure lies substantially at 90° to a wall of the vehicle in the restraint configuration and substantially parallel to the wall in the access configuration.

Advantageously, the rotatable base has a carriage providing translational movement of the support structure with respect to the floor of the vehicle.

Preferably, the restraint further comprises a floor plate which is part of or attached to the floor of the vehicle.

Conveniently, the carriage comprises a sliding bar fixed to the support structure and a guide therefor fixed to the floor plate upon which the carriage is mounted for translational movement.

Advantageously, the rotatable base comprises a bracket rotatably mounted on the floor plate, the bracket providing the guide to slidably receive the sliding bar, thereby providing rotational and translational movement of the support structure with respect to the floor of the vehicle.

Preferably, a locking mechanism is provided between the support structure and the floor plate to lock the support structure into position with respect to the floor plate.

Conveniently, the floor plate has a plurality of locating holes to co-operate with the locking mechanism and determine one or more locked positions of the support structure with respect to the floor plate.

Advantageously, the locking mechanism comprises a spring loaded plunger carried on the support structure biased to engage in one or more of the locating holes.

Preferably, the locking mechanism provides at least two locked positions: a seat position in which the plunger is located in one locating hole and the support structure is proximate to and substantially at 90° to the wall of the vehicle; and a restraint position in which the plunger is located in another locating hole and the support structure is spaced apart from the wall of the vehicle and substantially at 90° thereto.

Conveniently, the seat-back comprises a support frame and a seat-back frame interconnected by a linking mechanism operable to move the seat-back frame forwardly away from the support frame.

Preferably, the linking mechanism comprises a plurality of links pivotally connected to the support frame and the seat-back frame, the axes about which the links pivot being substantially parallel to the plane of the support frame.

Advantageously, a lever arm actuates the linking mechanism and is lockable in a position in which the seat-back frame is spaced apart from the support frame.

Conveniently, the lever arm has an over-dead-centre lock.

Preferably, the support frame and seat-back frame have a profile which outwardly flares at the upper corners thereof, the lower portion of the support frame and seat-back frame being narrow to accommodate the arms of a wheelchair either side thereof.

Another aspect of the invention provides a seating arrangement in a vehicle having a walled enclosure for carrying passengers, the arrangement comprising a restraint embodying the invention and one or more seats thereof.

Preferably, the restraint is located at one end of the enclosure intermediate a door accessing the enclosure and the one or more seats, the restraint being rotatable into the access configuration in which the support structure is rotated to lie substantially parallel to the wall of the enclosure to improve access to the enclosure of the vehicle from the door.

Conveniently, at least one of the one or more seats comprises a support structure comprising a leg arrangement, a seat-back and a seat squab, the leg arrangement being pivotable about a substantially vertical axis proximate the vehicle wall such that the seat-back lies substantially parallel to the wall.

Advantageously, the seat squab is removable.

Alternatively, the seat squab is hinged about the base of the seat-back to drop down and lie substantially flush below the seat-back.

Preferably, a further set of a restraint and one or more seats is provided separated by an aisle from the first set, the two restraints being rotatable to lie in their respective access configurations substantially opposite one another.

In order that the invention may be more readily understood, and so that further features thereof may be appreciated, the invention will now be described, by way of example, with reference to the accompanying drawings in which:

FIGURE 1 is a perspective view of a restraint embodying the present invention in a seat configuration;

FIGURE 2 is a perspective view of the restraint of Figure 1 in a wheelchair configuration with the seat-back in a rear position and the seat squab stowed;

FIGURE 3 is a perspective view of a lower part of the restraint of Figure 1 with a carriage locked-on to a floor plate in the wheelchair restraint configuration;

FIGURE 4 is a perspective view of the lower part of the support structure of the restraint of Figure 1 with the carriage intermediate the wheelchair restraint configuration and the seat configuration;

FIGURE 5 is a perspective view of the lower part of the restraint embodying the present invention with the carriage in the seat configuration substantially adjacent a wall of a vehicle;

FIGURE 6 is a perspective view of the lower part of the restraint embodying the present invention with the carriage rotated through 90° from the seat and wheelchair restraint configurations in an access configuration;

FIGURE 7 is a perspective view of the support structure for the restraint embodying the present invention with the squab removed and the seat-back in a rear position;

FIGURE 8 is a perspective view of the upper part of the support structure for the restraint embodying the present invention showing the seat-back in a forward position spaced apart from the seat-back support frame;

FIGURE 9 is a perspective rear view of a link system for use with the restraint embodying the present invention with the seat-back deployed in a forward position;

FIGURE 10 is a perspective view of a rear-end of a seat squab for use with the support structure of the restraint embodying the present invention;

FIGURE 11 is a perspective side view of a squab locking arrangement in an unlocked condition;

FIGURE 12 is a perspective side view of the locking arrangement of Figure 11 in a locked condition;

FIGURE 13 is a schematic perspective view of a winching arrangement for use with the restraint embodying the present invention, other parts of the support structure being shown cut-away;

FIGURE 14 is a schematic side view of the winching arrangement of Figure 13 in a released condition;

FIGURE 15 is a schematic side view of the winching arrangement of Figure 13 in a locked condition;

FIGURE 16 is a perspective side view of a restraint embodying the present invention having webbing attached to a frame of a wheelchair;

FIGURE 17 is a schematic plan view of a vehicle fitted with two restraints embodying the present invention and four forward seats, one of the restraints being in the seat configuration and the other of the restraints being in an access configuration;

FIGURE 18 is a schematic plan view of one half of a vehicle passenger area equipped with a restraint embodying the present invention and two forward seats, the forward seats being rotated against the vehicle wall and the restraint being in the wheelchair restraint configuration;

FIGURE 19 is a schematic rear view of a lower portion of a forward seat for use with embodiments of the present invention, a removable or stowable leg of the seat being shown in phantom;

FIGURE 20 is a schematic side view of the forward seat of Figure 19 in a seat configuration; and

FIGURE 21 is a schematic side view of the seat of Figure 19 in an access configuration.

It is to be understood that embodiments of the invention involve use of retractors. Retractors are components which are in wide use in connection with safety-belt systems in motor vehicles. A typical retractor comprises a housing containing a rotatably mounted spring-biased spool. One end of a length of webbing, typically a safety-belt, is connected to the spool and, on rotation of the spool in the appropriate sense, can be paid-out by the retractor or withdrawn into the retractor. The spool is associated with a spring which is adapted to impart a bias to the spool which tends to draw the webbing into the housing. The retractor incorporates an integral locking mechanism which is adapted to lock the spool in response to an accident situation. In many cases the locking mechanism of a retractor has an inertia member in the form of a pendulum, or a ball in a cup, or a so-called "standing man". When each of these inertia members is subjected to a deceleration in excess of a predetermined threshold, the inertia member will execute a predetermined movement. Thus the pendulum will swing, the ball will rise up in the cup, and the "standing man" will topple over to be restrained in a slightly inclined position by a surrounding guide. The locking mechanism becomes locked in response to this predetermined movement.

It has long been known that the sensors used in retractor reels are gravity-sensitive, and if a conventional retractor is inclined, relative to its ordinary position, for example when a motor vehicle in which the retractor is mounted is parked on a slope, then the retractors may "lock" even though it is not subjected to any deceleration whatsoever. Often this feature of retractors is a problem, but, in the present invention, advantage is taken of this particular feature of known retractor reels.

There are many commercially available retractor reels which possess the feature of locking when inclined relative to an initial operating position, and any of those retractor reels could be used in embodiments of this invention.

Referring to Figures 1 and 2, a preferred restraint is a device which can function as a conventional seat for a substantially able-bodied occupant and as a wheelchair restraint. Thus, the device has a first configuration, a seat configuration, as shown in Figure 1, in which the device functions as a conventional seat, and a second configuration, a restrain configuration, as shown in Figures 2, 5 in which the device functions as a wheelchair restraint to restrain a wheelchair and provide substantially the same degree of protection for the wheelchair occupant as for a normally seated passenger. The device includes a support structure 1 which comprises two spaced apart vertical support legs 2, 3, each provided at a lower end with a pair of transversely mounted wheels 4, 5, to form a carriage 6 to facilitate a transverse rolling movement of the device, see Figures 3 to 6. The wheels 4, 5 run on a floor plate 7 to which the support structure 1 is further connected by a bracket 8 and sliding bar 9 arrangement. The bar 9 horizontally bridges the support legs 2, 3. The bracket 8 is U-shaped, having a base 10 and two

upstanding arms 11 within each of which is provided an eye 12 - the two eyes 12 providing guides for the sliding bar 9 mounted therein. Preferably, the bracket 8 is rotatably fixed to the floor plate 7 by a bolt 13 passing through the centre of the bracket base 10 to create a pivot point. The floor plate 7 is provided as part of or fixed to the floor of the vehicle.

Between one pair of the wheels 5 fixed on the support structure 1 (the right hand wheels 5 in this example), there is mounted a spring-loaded plunger 14 biased such that the plunger head of the plunger 14 protrudes below the running plane of the wheels 4, 5. The floor plate 7, which in this example is shown for being securely mountable on a floor of the vehicle, is rectangular and has four equally-spaced holes provided along its longitudinal axis. The bracket bolt 13 secures the bracket 8 to the floor plate 7 through a pivot point hole 15. With the bracket 8 at its furthest point of travel along the sliding bar 9 from the plunger 14 as shown in Figure 3, the plunger head is located in a locating hole 16 in the floor plate 7, the restraint locating hole 16. The restraint locating hole 16 is visible in Figures 5 and 6. Another locating hole 17, the seat locating hole 17 lies intermediate the pivot point hole 15 to which the bracket 8 is fixed and the restraint locating hole 16. A further locating hole 18, the reverse seat locating hole 18, is located on the opposite side of the bracket 8 to the seat locating hole 17.

As will be explained later, the plunger 14 can be located in any of the locating holes 16, 17, 18 to lock the support structure 1 into position. Thus, the plunger 14 can be locked in the restraint locating hole 16 to function as a wheelchair restraint, the seat locating hole 17 to function as

a seat and in the reverse seat locating hole 18 if the seat support is to face in the opposite direction.

A hinged flap 7A is provided as part of the floor plate 7 adjacent the restraint locating hole 17 and having a locating eye 7B formed thereon. When in the restraint configuration, a registration pin 3A on the outer surface of the support leg 3 adjacent the plunger 14 engages in the eye. When in the seat configuration, the flap is hinged to lie flat within the floor plate 7 so as to reduce the trip hazards.

Referring to Figure 7, the upper edges of the two vertical support legs 2, 3 are interconnected by a substantially horizontal transverse plate 19.

A substantially rectangular seat-back support frame 20 has a pair of tubular uprights 21, 22 the lower ends of which are spanned by a base plate 23. The base plate 23 is fixed to the transverse plate 19. These two plates 19, 23 together form an energy-absorbing mechanism, in the event of a collision. The upper regions 24, 25 of the tubular uprights 21,22 outwardly flare (as best seen in Figure 7) and are joined at their ends by a tubular head bar 26, thereby completing the seat-back support frame 20. At the rear of the head bar 26 are a pair of loop guides 27, one in each of the flared upper corners 24, 25 of the seat-back support frame 20 for correctly locating and holding safety-belts.

The seat-back support frame 20 is mechanically connected to a cushioned seat-back frame 28, the seat back, by a link system 29. The seat-back 28 comprises a substantially rectangular frame 30 of rectangular tubing conforming in shape to the seat-back support frame

20 and is appropriately upholstered. The link system 29 comprises four separate links 29A, B, C, D each of which comprises a first arm 31 hingedly mounted to the seat-back support frame 20 for rotational movement in substantially a horizontal plane (i.e., substantially parallel to a vehicle floor) and a second arm 32 bolted at one end to the free end of the first arm 31. The other end of the second arm 32 is bolted to the seat-back 28, again for rotation in a plane substantially parallel to the plane of rotation of the first arm 31. The two arms 31, 32 have substantially collapsed together until they are almost parallel with one another when the seat-back 28 lies against the seat-back support frame 20 as shown in Figures 1 and 7. However, with the seat-back 28 spaced apart from the seat-back support frame 20 as shown in Figures 8 and 9, the two arms 31, 32 rotate with respect to one another and serve as an expandable link between the seat-back support frame 20 and the seat-back 28, and maintaining the two parallel to one another.

Two such links are provided toward the upper region of each of the two frames 20, 28 and two further links are provided near the lower region of each of the two frames 20, 28 so there is effectively one link in each of the four corners of the frames. The apexes of the links 29A, 29B in the upper region of the frame face one another and the apexes of the two links 29C, 29D in the lower region of the frames also face one another as shown in Figure 8. By orienting the links so that the link arms rotate in a substantially horizontal plane, there is less play or relative movement of the seat-back frame in the vertical direction with respect to the seat-back support frame 20 than if the links 29 were oriented to rotate in a substantially vertical plane.

The above-described link system supports the movement of the seat-back 28 from a first configuration in which the seat-back 28 lies against the seat-back support frame 20 (Figure 1) into a second configuration, a forward position, in which the seat-back 28 is spaced apart from the seat-back support frame 20 (Figure 8).

The link system 29 is augmented by an actuator 33 which in the illustrated example is best seen in Figures 8 and 9 comprises a hinged lever arm 34 (in fact three parallel and spaced-apart lever arms) which are joined at their free end by a runner bar 35, a portion 36 of the end of the runner bar 35 protruding past the lateral extent of the lever arms 34. A substantially square plate 37 is attached to the back of the seat-back 28 spanning the seat-back tubular uprights 38, 39 and presenting a pair of longitudinal flanges 40, 41 one on each side of the seat-back 28 running substantially adjacent to and parallel with the seat-back uprights 38, 39 . A guide slot 42 is formed along the length of each of the flanges 40, 41 and the end portions 36 of the runner bar 35 are each disposed in a respective guide slot 42. With the seat-back 28 lying adjacent the seat-back support frame 20, the runner bar 35 is at the top of its travel within the guide slots 42 but pushing the lever arm 34 downwardly with the aid of a handle 43 attached to the lever arm, the runner bar 35 descends down the guide slots 42 pushing the seat-back 28 away from the seat-back support frame 20 but maintaining the seat-back 28 parallel to the seat-back support frame 20 by means of the link system 29. Preferably, the actuator 33 is an over-dead-centre actuator such that the ends 36 of the runner bar are locked in position at their extent of travel at the bottom of the guide slots 42.

In the described embodiment, see Figure 7, the support structure 1 is provided with two integral safety-belt arrangements 44, 45 each having an internal safety-belt retractor 46, 47 which is associated with a safety-belt 44, 45 having a tongue 48 which can be engaged within a buckle 49 which is fixedly mounted on the support structure. In the illustrated embodiment two such retractors and associated safety-belts and buckles and two tongues are provided, the safety-belts and buckles being located so that either one of the safety-belts may be utilised at any one time, thus providing a lap-and-diagonal safety-belt. Each of the safety-belts 44, 45 pass through one of the loop guides 27 in the flared upper corners 24, 25 of the support frame 20. By selecting which safety-belt is utilised it is possible for a seat occupant to be provided with a lap-and-diagonal safety-belt over the left shoulder or over the right shoulder. Alternatively, both belts can be used to effectively form a harness in the case of a passenger with a posture problem.

Referring to Figure 1, a seat squab 50 is provided. On opposing sides of the under-surface of the squab are provided a pair of rearwardly projecting fingers 51, 52 to releasably engage part of the support structure 1. The figures 51, 52 are shown in Figure 10. A rod 53 is held between the two fingers 51, 52 the free ends 54, 55 of the rod 53 protruding past the fingers 51, 52 to form projecting pins 54, 55 on opposite sides and underneath the seat squab 50. The fingers are spaced apart by a distance so as to fit between the inner surfaces of the support legs 2, 3. A block 56 (see Figure 6) is attached to the inner surface of each of the support legs 2, 3 just below the transverse plate 19. The upper surface of the block 56 is spaced apart from the lower surface of the transverse plate 19 by a slightly greater distance than the width of the fingers 51, 52. Thus, the squab 50 can be slid backwards into the

support structure 1 with the fingers 51, 52 passing below the transverse plate 19 and above the blocks 56 until a pair of steps 57 on the fingers abut the transverse plate 19. A small tab 58 is provided on the end of each of the fingers 51, 52 at the upper surface thereof to offer engagement with the back of the block 56 to provide a temporary restraint until the squab 50 is positively locked into position. As shown in Figures 11 and 12, a locking arm 59 having a hook 60 at one end is provided on each of the outer surfaces of the support legs 2, 3 and is rotatable to latch onto the pins 54, 55 projecting from the fingers thereby securing and positively locking the squab 50 to the support legs 2, 3. The locking arm 59 carries a spring-loaded plunger 61 biased to engage in a locking hole 62 provided in each of the support legs 2, 3 when the hook 60 of the locking arm 59 engages with the pins 54, 55 as shown in Figure 12 .

Referring to Figures 13 to 15, a lower transverse element is provided, (see Figures 4 and 7) located towards the lower part of the support legs 2, 3 the lower transverse element being in the form of a rectangular plate 63 which is welded in position or connected to the support legs 2, 3 by means of tennon-type joints. The upper part of the transverse element is provided with a pair of wedge-shaped elements 64 provided with a serrated sloping upper surface 65. The wedge-shaped elements 64 are located half-way along the transverse element 63..

Extending horizontally between the two support legs 2, 3 above the transverse element is a transverse rotatable bar 66. The bar 66 is provided, at a central point, with a rearwardly and upwardly directed radially extending arm 67 which terminates in a foot-pedal 68 which is located to the rear of the support structure, which is thus readily

accessible. The foot-pedal 68 acts as a drive to rotate the rotatable bar 66. A short transverse rod 69 extends through the radially extending arm 67, with part of the rod 69 being on either side of the arm. A biasing mechanism is provided, constituted by two springs 70, 71. Each spring 70, 71 engages a respective projecting end of the short transverse rod 69, and also engages a transverse anchoring rod 72 which extends between the two support legs 2, 3. This biasing mechanism applies a bias to the rotatable bar 66 tending to rotate the bar in one sense.

A further central lug 73, carried by the rotatable bar 66 adjacent the base of the arm 67 carrying the foot-pedal 68, extends radially downwardly beneath the bar. The lug 73 pivotally supports one end of a dog 74 . A lanyard 75 is connected to the dog 74. The lanyard 75 passes through a guide loop 76 (See Figure 7) on the support structure so that one end of the lanyard is accessible, in this case at the top and rear of the seat-back support frame 20.

The forward end of the dog comprises a pointed fork, in the example shown in Figures 4 and 7, thus presenting an edge that can engage the serrated faces 65 of the wedge-shaped elements 64 provided on the upper surface of the lower transverse element 63.

The transverse rotatable bar 66 carries, adjacent each end thereof, but spaced slightly inwardly of the adjacent support leg 2, 3 a respective radially extending retractor carrying plate 76. Each radially extending retractor carrying plate 76 has, mounted thereon, a conventional retractor mechanism 77, which has a length of webbing 78, wound on the spool thereof.

In an initial position of the rotatable bar 66, the retractors 77, on the retractor support plates 76, are biased by the springs 70, 71 into contact with the anchoring rod 72 to which the springs 70, 71 are connected as shown in Figure 13. The anchoring rod 72 thus acts as a stop to limit the movement of the rotatable bar 66.

The webbing 78, from each retractor mechanism 77, passes over the adjacent anchoring rod 72 and then travels vertically downwardly to the transverse element 63 where the webbing 78 is fed through a guide 79 located on the transverse element 63 at a low level and terminates with a karabiner 78A or some other releasable mechanism as shown in Figures 6 and 16.

When the seat is in its seat configuration, the back-rest 28 is located adjacent the seat-back support frame 20, the squab 50 is in position supported by the support structure 1, the rotatable bar 66 is forwardly biased by the springs 70, 71. The retractors 77, are positioned so that webbing 78 may be drawn out from the retractors 77. Thus the retractors 77 are not locked.

With the seat in this condition, it is envisaged that the transverse rotatable bar 66, and the retractor mechanisms 77 carried thereby will be substantially invisible, and the only part of the support structure and the associated mechanisms described above that would be at all visible would be the foot-pedal 68. Indeed, a masking casing could be provided to mask the various components that have been described above, should such a casing be considered to be necessary.

The seat, in this condition, can be used as an ordinary vehicle seat.

Should an accident arise, with the seat in this condition, involving a frontal impact of the vehicle, the occupant of the seat will be retained by the safety-belt system 44, 45 that is integral with the seat and a substantial force may be applied to the back of the seat tending to move the top part of the back of the seat forwardly. The base plate 23 and the transverse plate 19 together provide a torsional energy absorption mechanism.

Referring now to Figures 17 and 18, restraints 1, embodying the present invention are fixedly mounted in a passenger area of a vehicle to the floor of the vehicle by floor plates 7. In this example, two restraints embodying the present invention are provided at the rear of a vehicle capable of seating six people in the passenger area in three rows, two abreast, bounded on either side by a vehicle wall 100. The seats at the rear of the vehicle are restraints 1, embodying the present invention. The seats 80 in the front two rows of the passenger area are configured as seats as opposed to wheelchair restraints.

In the lower part of Figure 17, the restraints 1 embodying the present invention has the seat support and carriage 6 locked in position adjacent the vehicle wall 100 and is configured as a conventional seat - the configuration shown in corresponding Figure 1 of the present Application. In the upper part of Figure 17, the restraint 1 embodying the present invention has had its seat rotated about the pivot point 15 between the seat support 1 and the floor plate 7 with the squab 50

removed so that the seat support 1 lies close against the wall 100, of the vehicle creating an access space between the rotated seat support 1 and an aisle of the vehicle (having a centre-line CL). Thus, it should be noted that the restraints embodying the present invention do not need to be detached from the vehicle or taken out of the vehicle to allow a wheelchair to be placed inside the vehicle and positioned against the restraint. Instead, the seat support 1 can simply have its squab removed and be rotated against the wall 100 to create the access space and the wheelchair 101 and occupant pushed into the vehicle forwardly past the rear restraint.

The forward seats 80 in the passenger area are preferably of the form shown in Figures 19 to 21 and are mounted on two tubular legs 81, 82, the leg 81 nearest the wall 100 being journalled to the floor or to the seat frame 83 and the leg 82 furthest from the wall being removable or detachable from the floor. The forward seats 80 are thus rotatable with this squab 84 removed or dropped down against the wall 100 to provide further access space if the rear restraint 1 is to be used to restrain a wheelchair. Figure 17 shows four such chairs 80 and their axis of rotation 85 with their squabs 84 in place in a seating configuration as shown in Figures 19 and 20. Referring now to Figure 21, the aisle leg 82 of each forward seat has been removed and the squab 84 dropped down. This seat is then rotated to lie substantially against the wall thereby creating space in the passenger area of the vehicle - particularly widening the aisle area as shown in Figure 18.

With the wheelchair restraints 1 at the rear of the vehicle rotated to lie substantially against the walls 100 and creating a large access space between the restraints 1 and with the forward seats 80 having their

squabs 84 dropped and seat supports 83 rotated substantially against the walls 100, there is adequate space to insert a wheelchair 101 and occupant from the rear of the vehicle and allow manoeuvring of one or two wheelchairs into position against the wheelchair restraints 1, once these have been re-rotated into their wheelchair restraining condition as shown in Figure 18. It will be noted that the restraints 1 embodying the present invention have a fixed condition substantially against the wall as shown in Figure 5 and the lower part of Figure 17 and a further fixed condition in which they can receive a wheelchair as shown in Figures 3 and 18. In the lower part of Figure 17 and Figure 5, the seat support 1 is substantially against the wall 100 whereas in Figures 3 and 18 the seat support 1 is moved away from the wall 100 toward the aisle of the vehicle so that the arms and wheels of one side of a wheelchair 101 can be located between the wheelchair restraint 1 embodying the present invention and the wall 100 of the vehicle. With the wheelchair 101 and occupant in the vehicle and located in the area past the restraints 1, the restraints 1 are rotated back into alignment with the floor plate 7 and the carriage 6 rolled along the floor plate 7 until the pin 34 projecting from the aisle support leg 3 engages in the hinged flap 7A and the plunger 14 engages in its restraint location hole 16.

It should be noted that the support structure 1 can be rotated through 180° about the pivot point 15 so that the plunger 14 is located on the other side of the pivot point 15 to that shown in Figure 5 and the plunger 14 locked into the reverse seat locating hole 18 to allow the seat to face in the opposite direction should this be required.

If the described arrangement is to be used with a wheelchair, the squab 50 of the seat may simply be removed, by releasing the locking

arms 59, grasping the squab 50 and pulling it upwardly and outwardly thus releasing the engagement of the fingers 51, 52 to the support structure 1. The squab 50 may be put to one side, temporarily. The hooks on karabiners 78A are paid out in front of the support as shown in Figure 16.

With the squab 50 of the seat 1 removed, the back-rest 28 may be moved forwardly relative to the seat-back support frame 20 simply by depressing the handle 43 and locking the lever arms 34 into position at the extent of their travel as shown in Figures 8 and 9. The back-rest 28 will then be in a forward position.

When the back-rest 28 is in the forward position, a wheelchair 101 may be located in position just in front of the support structure 1. The karabiners 78A or hooks mounted on the webbing straps 78, associated with the retractor mechanisms 77, may then be pulled forwardly and engaged with part of the frame of the wheelchair 101 as shown in Figure 16. This is facilitated by the fact that the retractor mechanisms 77 are in such a position that the webbing 78 may be freely withdrawn from the retractors.

The wheelchair 101 may then be moved so that the rear part of the wheelchair is located in front of the support structure 1. As the wheelchair 101 is moved to this position, the retractors 77 automatically retract the webbing 78 so that the webbing 78 is held with a slight degree of tension provided by the retractor springs within the retractor mechanisms.

The foot-pedal 68 may now be actuated to rotate the rotatable bar 66. As the rotatable bar 66 rotates from the condition shown in Figure 14, so the angle of inclination of the radial retractor carrying plates 76 increases and thus the angle of inclination of each retractor mechanism 77 will increase, and during this movement some webbing 78 will be paid-out. When the angle of inclination of the retractor mechanisms 77, reaches a predetermined threshold, the integral gravity-sensitive locking mechanism within each retractor 77 will lock, thus preventing further webbing 78, being withdrawn from the retractors 77. As continued pressure is applied to the foot-pedal 68, the rotatable bar 66 will continue to rotate, thus moving the retractors 77, about an arcuate path gently moving the retractors 77 away from the front part of the support structure 1, applying tension to the webbing 78, and thus applying a force to the wheelchair 101 which firmly urges the wheelchair 101 into contact with the front part of the support structure, particularly the back-rest 28.

As the transversely extending bar 66 is rotated, so the forked end of the dog 74 defining the edge will move down the inclined serrated faces 65 provided on the wedge-shaped elements 64 located on the lower transverse element 63 located at the base of the support legs 2, 3. When pressure is removed from the foot-pedal 68, the rotatable bar 66 will tend to rotate in the opposite direction due to the resilient force applied thereto by the resilient mechanism constituted by the two springs 70, 71 and the tension in the webbing 78. This will bring the forked end of the dog 74 defining said edge firmly into engagement with one of the serrations on each of the wedge-shaped elements 64 with the dog 74 and serrations acting as a ratchet locking arrangement, thus preventing further movement of the rotatable bar 66 in that direction. The

wheelchair 101 is thus held firmly in position by the tension in the webbing 78.

As the retractors 77, and the optional guides 79 that the webbing 78 passes through, are relatively low, the webbing 78 applies a rearwardly and downwardly directed force to the frame of the wheelchair 101, firmly pulling the wheelchair 101 into position adjacent the restraint 1.

It is to be appreciated that, if desired, the foot-pedal 68 may be utilised to draw the wheelchair 101 into position adjacent the described restraining device 1 from a position spaced away from the restraining device 1. As described above, the karabiners or hooks 78A, will be engaged with the wheelchair 101. The foot-pedal 68 may then be operated which will serve to draw in some of the belt or webbing 78, that has been drawn out from each retractor 77. If an accessible end of the lanyard 75, which may be guided by guide loops provided on the support structure, is pulled, the effect is that the dog 74 is lifted from the serrated faces 65 of the wedge-shaped elements 64 and the retractors 77, are returned to their initial position under the influence of the two springs 70, 71. As the retractors 77 move back to their initial position, the locking mechanisms become released, and the spring-biased spools within the retractors 77 draw in the webbing 78. Thus the wheelchair 101 remains stationary during this particular phase of operation, and webbing 78 is drawn into the retractors 77. When again the foot-pedal 68 is pressed, the described cycle of operation will be repeated, the retractors 77 locking, and the subsequent movement of the retractors 77 causing the draw the wheelchair 101 closer to the described restraint.

This procedure may therefore be repeated until the wheelchair has been "winched" firmly into position adjacent the restraint.

The wheelchair 101 is thus secured against the combination of the support structure and the back-rest 28 of the seat, with the back-rest 28 of the seat being located at the front part of the support structure so that the back-rest 28 of the seat is then positioned immediately behind the back-rest of the wheelchair 101. The occupant of the wheelchair 101 can then easily use one of the safety-belt arrangements 44, 45 provided on the back-rest of the vehicle seat and will be retained thereby. Electric wheelchairs can also be readily accommodated since the back-rest 28 in the forward position creates a void under the back-rest 27, in the absence of the squab 50, into which the battery pack and motor of an electric wheelchair can be readily received.

The squab 50 may then conveniently be temporarily located in position at the rear of the support structure by sliding the fingers 51, 52 into a receiving bracket 90 at the rear of the support legs 2.3 with the cushioned surface facing outwardly. In this position the squab 50 will help protect the described support structure from inadvertent kicks from the rear, and will provide some protection if a passenger behind the restraint 1 is thrown forwardly in an accident.

In the event that an accident should occur involving a frontal impact of the vehicle in which the seat is mounted, the occupant of the wheelchair will be restrained by the safety-belt system provided on the back rest of the seat, and a substantial force may be applied to the support structure that has been described above. For wheelchair users with low or no posture control, both safety-belt systems 44, 45 can be

used. The support structure and the back-rest are designed to be strong enough to withstand anticipated force levels.

If there is a rear impact involving the motor vehicle in which the described restraint is fitted, the back-rest of the seat will be brought into contact with the back-rest of the wheelchair, and thus effectively into contact with the back of the occupant of the wheelchair, the link system acting as an energy absorption mechanism.

Moreover, if seats located forwardly of a seat being used as wheelchair restraint are rotated so that they lie against the side wall of the vehicle, they will also offer a measure of side impact protection to the occupant of the wheelchair.

When the vehicle has reached its destination and the wheelchair is to leave the vehicle, a further slight pressure is applied to the foot-pedal 68, thus rotating the rotatable bar 66 in a direction which applies a further slight tension to the webbing 78. The lanyard 75 that is connected to the dog 74 is then grasped and is pulled to move the dog 74 slightly upwardly. Thus the edge of the dog 74 becomes disengaged from the serrated face 65 on the wedge-shaped elements 64.

If the pressure applied to the foot-pedal 68 is then released, the rotatable bar 66 will then rotate, under the resilient bias provided by the springs 70, 71 and due to the tension in the webbing 78, to its initial position in which the radially extending retractor carrying plates 76, are inclined such that the gravity-sensitive locking mechanism in each of the retractor mechanisms 77, is released. The webbing 78, can then be paid-out from the retractor mechanisms permitting the wheelchair 101 to

be moved forwardly so that the karabiners or hooks 78A, can be disengaged therefrom.

If the karabiners or hooks 78A, are simply released, the retractor mechanisms 77 would automatically wind-in the webbing, so that webbing is no longer exposed.

If the seat is again to be used as a conventional seat, the seat-back 28 may be moved to its initial rear-most position simply by lifting the handle 43 from its locked position to collapse the link system 39 bringing the seat back 28 rearwardly with a translational movement into abuttment with the seat-back support frame 20 . The squab 50 may be replaced in its initial place, and the seat is then again in its initial condition for use as a conventional seat. The plunger 14 is also released from the restraint locating hole 16 and the seat support 1 rolled back towards the wall 100 where the plunger 14 is locked into the seat locating hole 17.

It is to be understood that since the restraining device of the present invention is in the form of a seat which can be used as a conventional seat, there is no need to remove the seat from the vehicle, if the vehicle is to carry a passenger in a wheelchair. All that is required is for the seat squab to be removed, the support structure rotated to lie substantially against a wall of the vehicle to facilitate access to the vehicle for the wheelchair and the position of the seat-back to be adjusted, and then the restraining device may be used to restrain a wheelchair occupant. Consequently it is envisaged that there may be no need to remove a vehicle seat which constitutes a restraining device in

accordance with the invention from the motor vehicle, enabling the seat to be mounted securely and permanently in position.

Whilst in the initially described embodiment as shown in the Figures, the back of the seat is supported on a system of links, it is of course possible to use other forms of linking mechanisms, such as a telescopic tube arrangement, for supporting a back rest on a support structure so the back rest can move from a rear-most position to a forward-most position.

In the present Specification "comprises" means "includes or consists of" and "comprising" means "including or consisting of".

The features disclosed in the foregoing description, or the following Claims, or the accompanying drawings, expressed in their specific forms or in terms of a means for performing the disclosed function, or a method or process for attaining the disclosed result, as appropriate, may, separately, or in any combination of such features, be utilised for realising the invention in diverse forms thereof.

CLAIMS:

1. A restraint for restraining an item in a vehicle, the restraint comprising a support structure to be mounted on the floor of the vehicle, the support structure carrying a removable seat squab, a seat-back which is provided with a safety-belt arrangement and a securing arrangement to engage the item to be restrained, the support structure being mounted on the floor of the vehicle by a rotatable base having a restraint configuration in which the support structure is in a position to receive and restrain the item and an access configuration in which the support structure is rotated from the restraint configuration to improve access to the vehicle.

2. A restraint according to Claim 1, wherein the support structure is rotatable through substantially 90° between the restraint configuration and the access configuration.

3. A restraint according to Claim 1 or 2, wherein the support structure lies substantially at 90° to a wall of the vehicle in the restraint configuration and substantially parallel to the wall in the access configuration.

4. A restraint according to any preceding claim, wherein the rotatable base has a carriage providing translational movement of the support structure with respect to the floor of the vehicle.

5. A restraint according to Claim 4, wherein the restraint further comprises a floor plate which is part of or attached to the floor of the vehicle.

6. A restraint according to Claim 4 or 5, wherein the carriage comprises a sliding bar fixed to the support structure and a guide therefor fixed to the floor plate upon which the carriage is mounted for translational movement.

7. A restraint according to Claim 6, wherein the rotatable base comprises a bracket rotatably mounted on the floor plate, the bracket providing the guide to slidably receive the sliding bar, thereby providing rotational and translational movement of the support structure with respect to the floor of the vehicle.

8. A restraint according to Claim 5, wherein a locking mechanism is provided between the support structure and the floor plate to lock the support structure into position with respect to the floor plate.

9. A restraint according to Claim 8, wherein the floor plate has one or more locating holes to co-operate with the locking mechanism and determine one or more locked positions of the support structure with respect to the floor plate.

10. A restraint according to Claim 9, wherein the locking mechanism comprises a spring loaded plunger carried on the support structure biased to engage in one or more of the locating holes.

11. A restraint according to any preceding claim, wherein the locking mechanism provides at least two locked positions: a seat position in which the plunger is located in one locating hole and the support structure is proximate to and substantially at 90° to the wall of the vehicle; and a restraint position in which the plunger is located in another locating hole and the support structure is spaced apart from the wall of the vehicle and substantially at 90° thereto.

12. A restraint according to any preceding claim, wherein the seat-back comprises a support frame and a seat-back frame interconnected by a linking mechanism operable to move the seat-back frame forwardly away from the support frame.

13. A restraint according to Claim 12, wherein the linking mechanism comprises a plurality of links pivotally connected to the support frame and the seat-back frame, the axes about which the links pivot being substantially parallel to the plane of the support frame.

14. A restraint according to Claim 12 or 13, wherein a lever arm actuates the linking mechanism and is lockable in a position in which the seat-back frame is spaced apart from the support frame.

15. A restraint according to Claim 14, wherein the lever arm has an over-dead-centre lock.

16. A restraint according to any one of Claims 12 to 15, wherein the support frame and seat-back frame have a profile which outwardly flares at the upper corners thereof, the lower portion of the support frame and

seat-back frame being narrow to accommodate the arms of a wheelchair either side thereof.

17. A seating arrangement in a vehicle having a walled enclosure for carrying passengers, the arrangement comprising a restraint according to any preceding claim and one or more seats thereof.

18. A seating arrangement according to Claim 17, wherein the restraint is located at one end of the enclosure intermediate a door accessing the enclosure and the one or more seats, the restraint being rotatable into the access configuration in which the support structure is rotated to lie substantially parallel to the wall of the enclosure to improve access to the enclosure of the vehicle from the door.

19. A seating arrangement according to Claim 18, wherein at least one of the one or more seats comprises a support structure comprising a leg arrangement, a seat-back and a seat squab, the leg arrangement being pivotable about a substantially vertical axis proximate the vehicle wall such that the seat-back lies substantially parallel to the wall.

20. A seating arrangement according to Claim 19, wherein the seat squab is removable.

21. A seating arrangement according to Claim 19, wherein the seat squab is hinged about the base of the seat-back to drop down and lie substantially flush below the seat-back.

22. A seating arrangement according to any one of Claims 17 to 21, wherein a further set of a restraint and one or more seats is provided

separated by an aisle from the first set, the two restraints being rotatable to lie in their respective access configurations substantially opposite one another.

23. A restraint substantially as hereinbefore described with reference to and as shown in the accompanying drawings.

24. Any novel feature or combination of features disclosed herein.

ABSTRACT

A restraint for restraining an item in a vehicle, the restraint comprising a support structure to be mounted on the floor of the vehicle, the support structure carrying a removable seat squab, a seat-back which is provided with a safety-belt arrangement and a securing arrangement to engage the item to be restrained, the support structure being mounted on the floor of the vehicle by a rotatable base having a restraint configuration in which the support structure is in a position to receive and restrain the item and an access configuration in which the support structure is rotated from the restraint configuration to improve access to the vehicle.

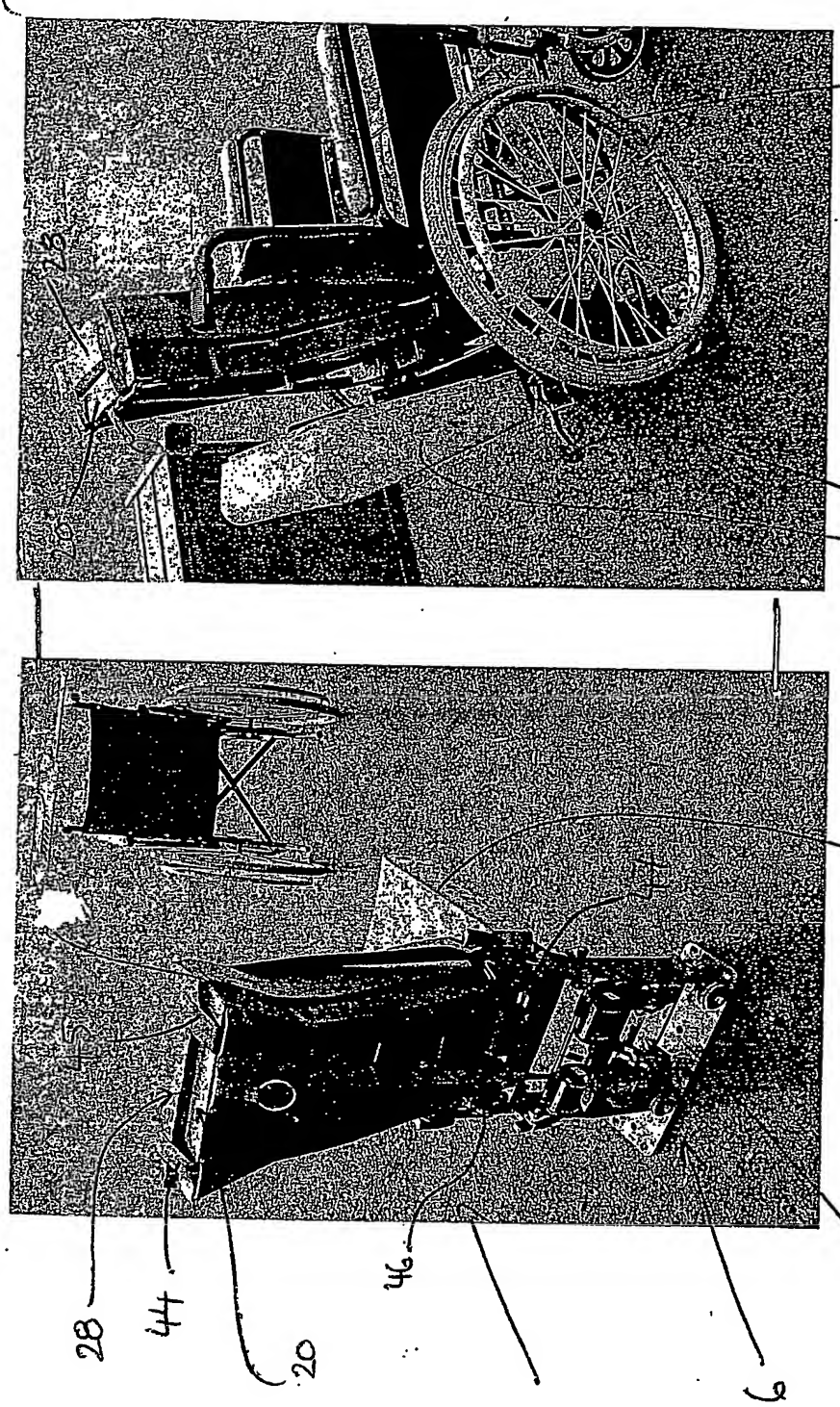


Figure 2

Figure 1

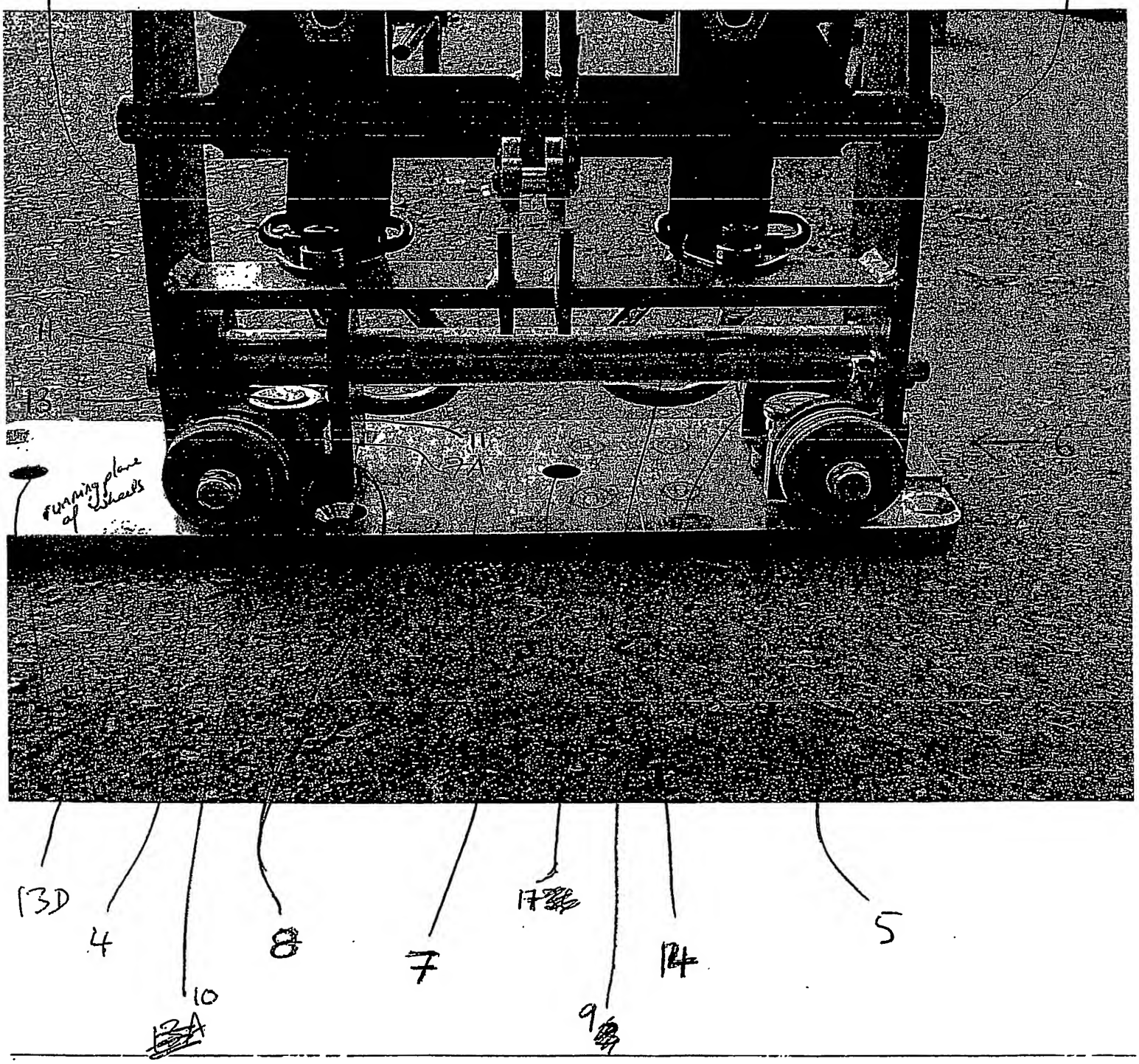


Figure 3

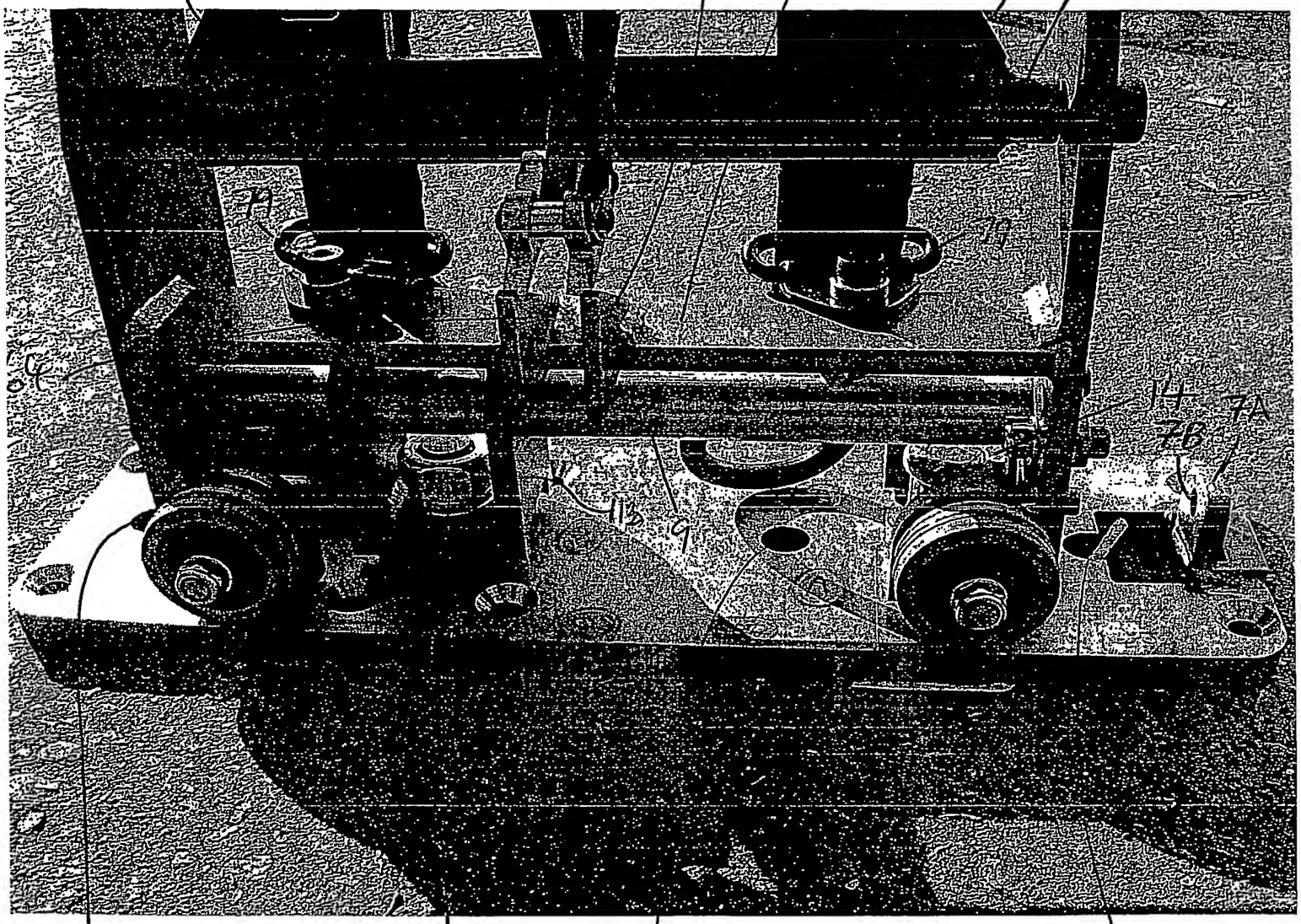


Figure 4

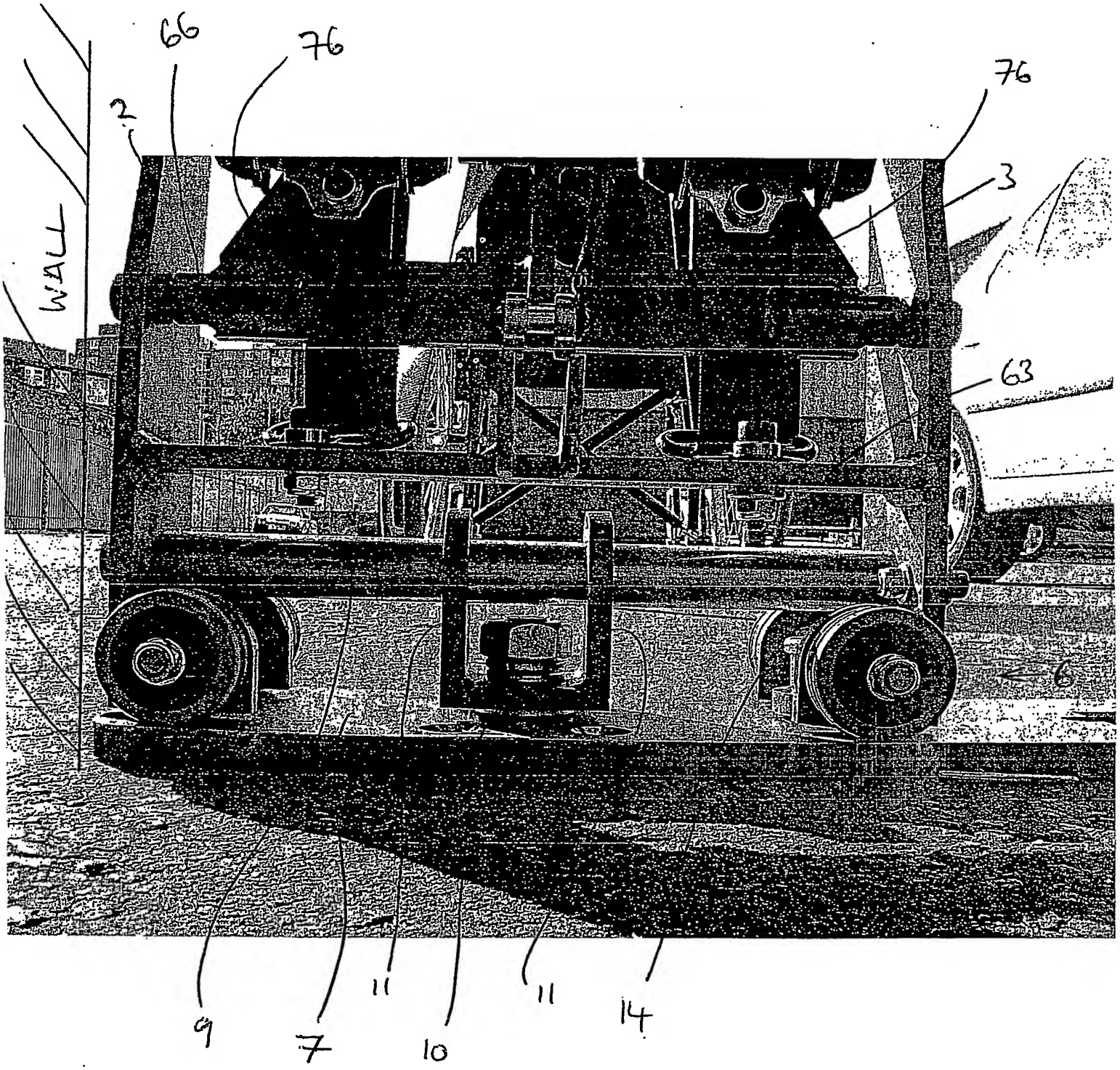


Figure 5

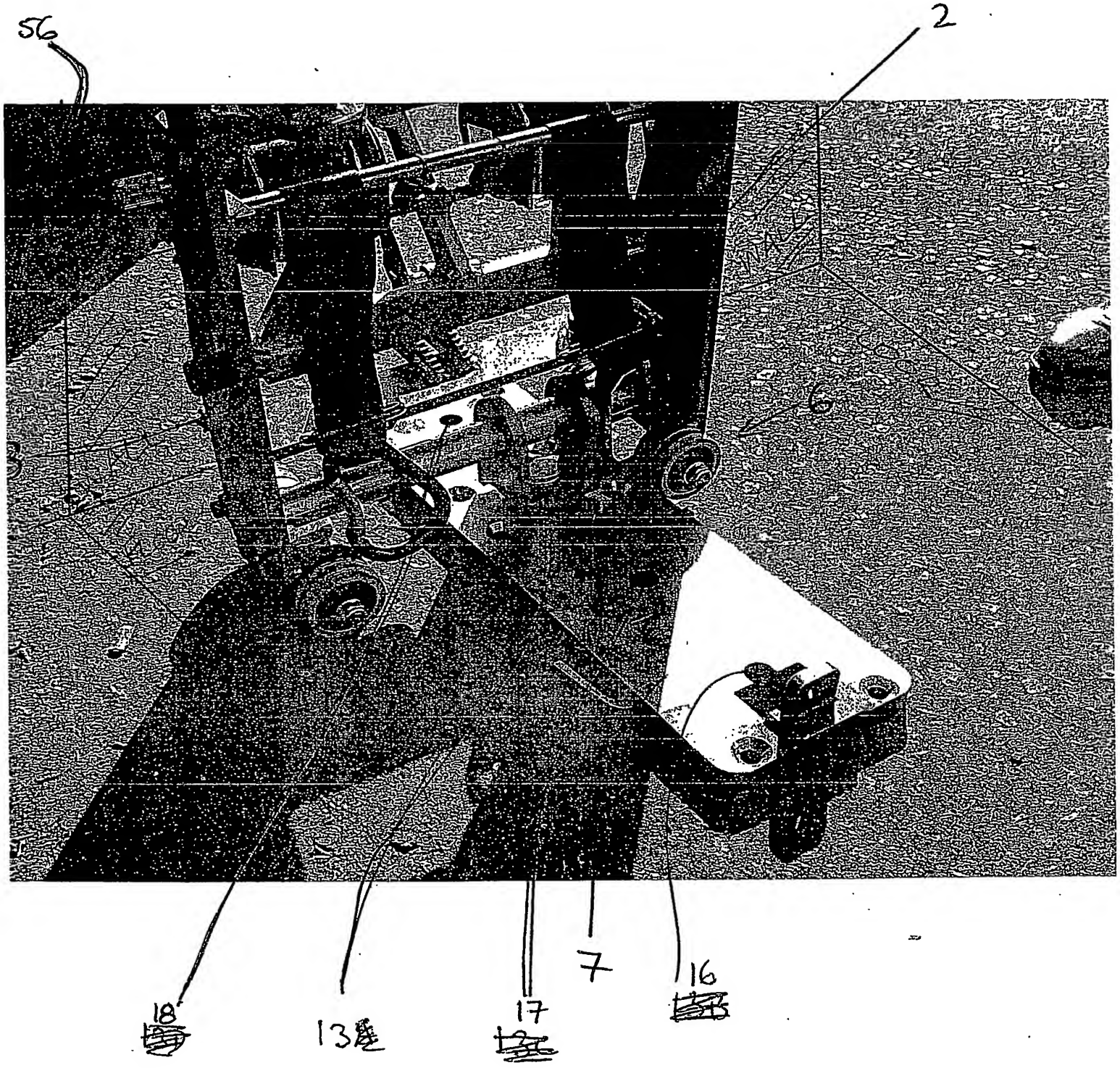
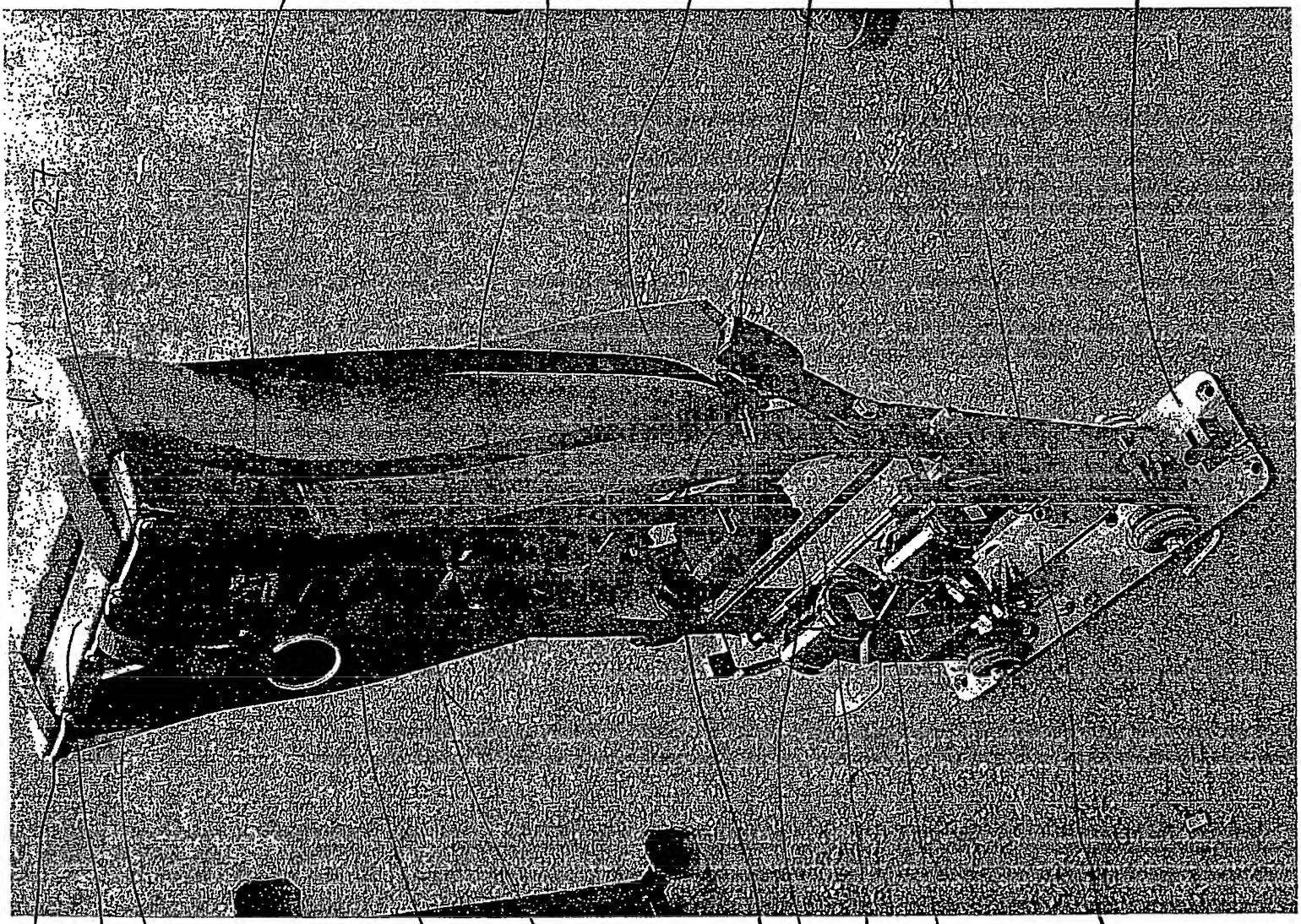


Figure 6

Figure 70



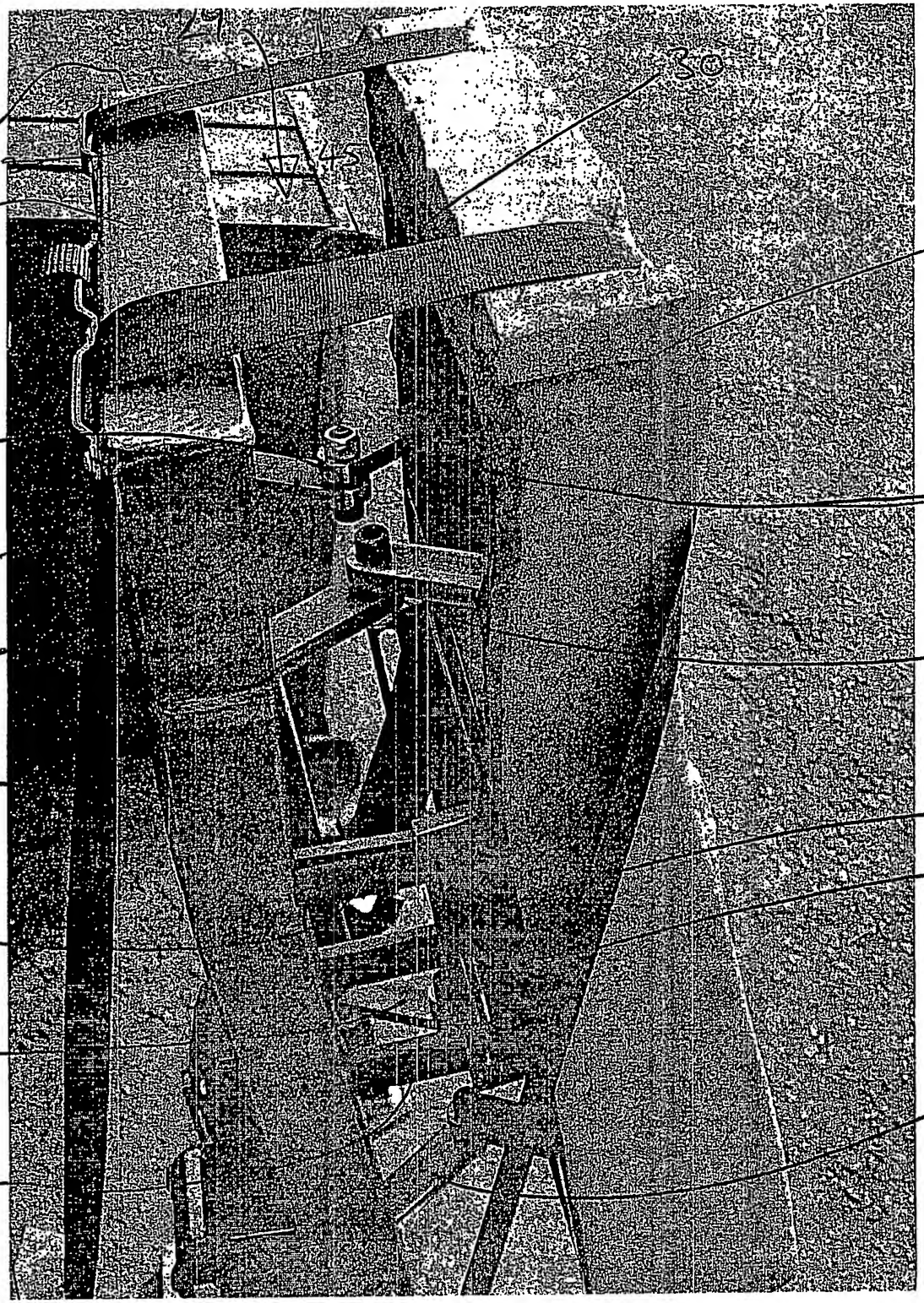


Figure 8

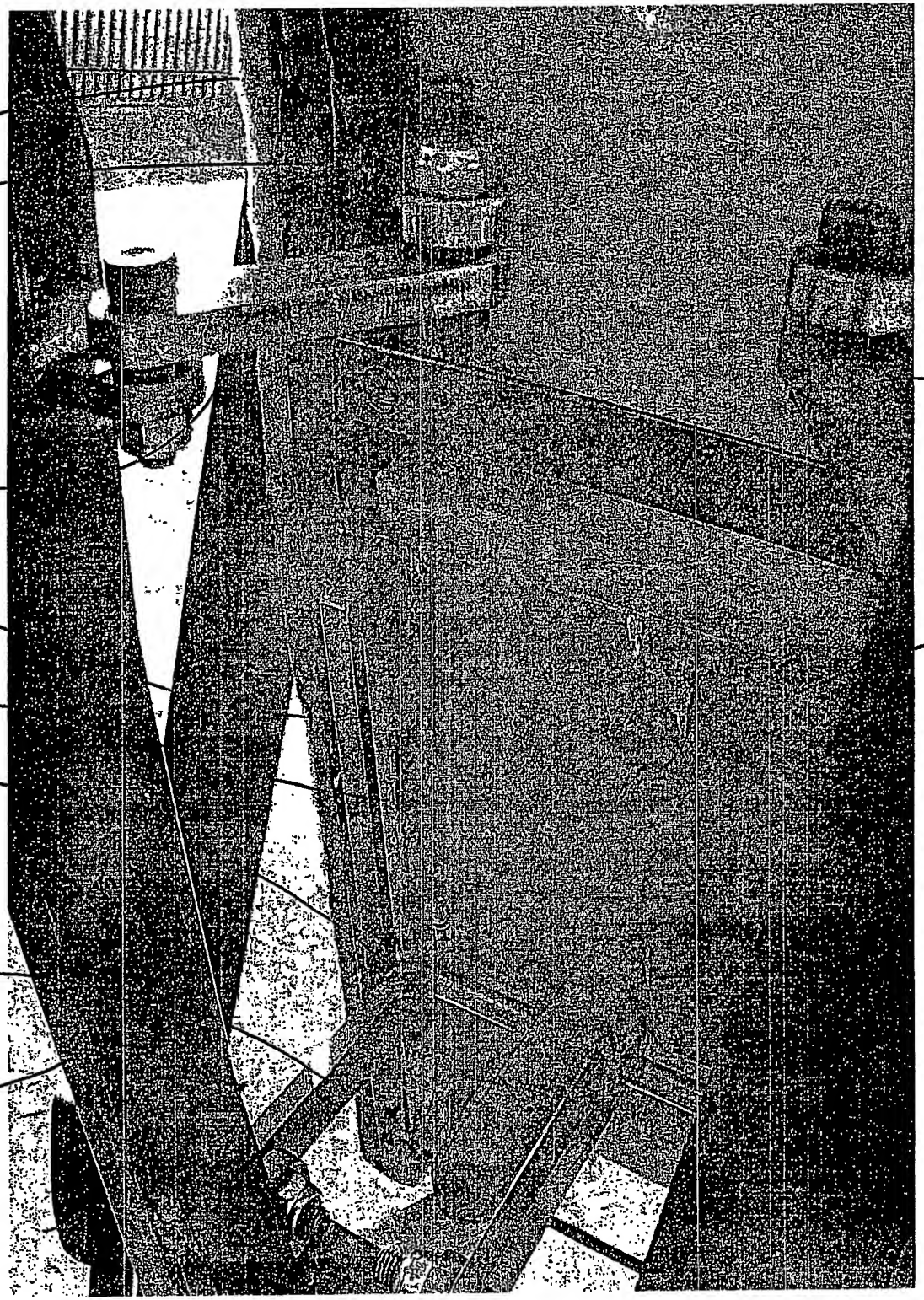


Figure 9

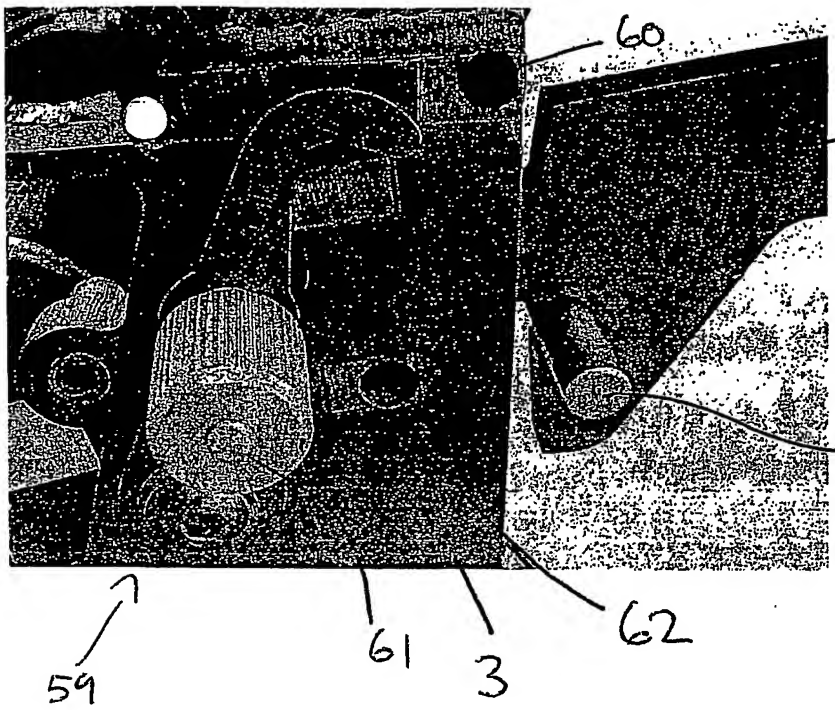


Figure 11

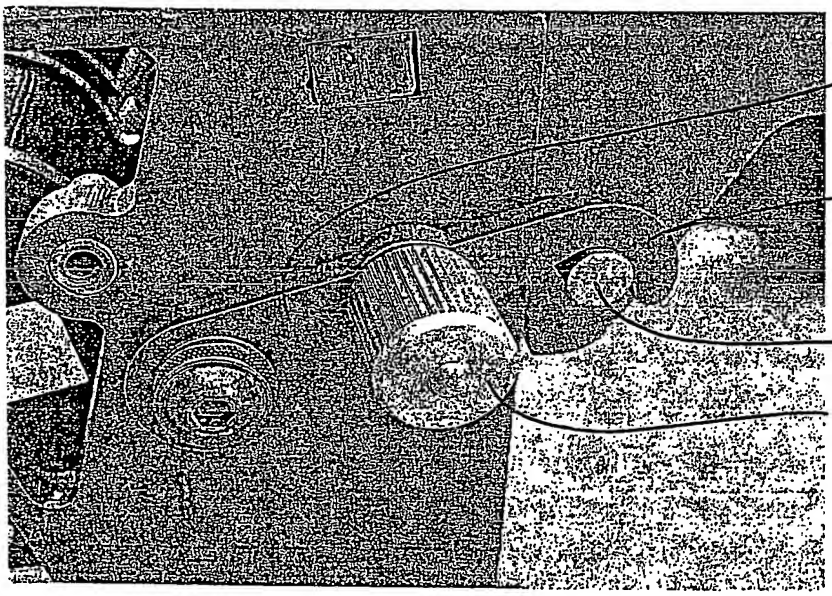


Figure 12

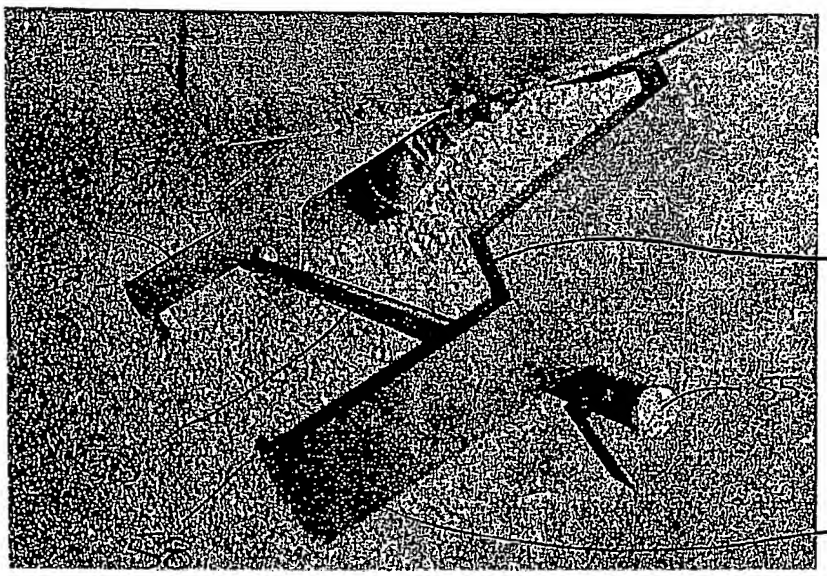


Figure 10

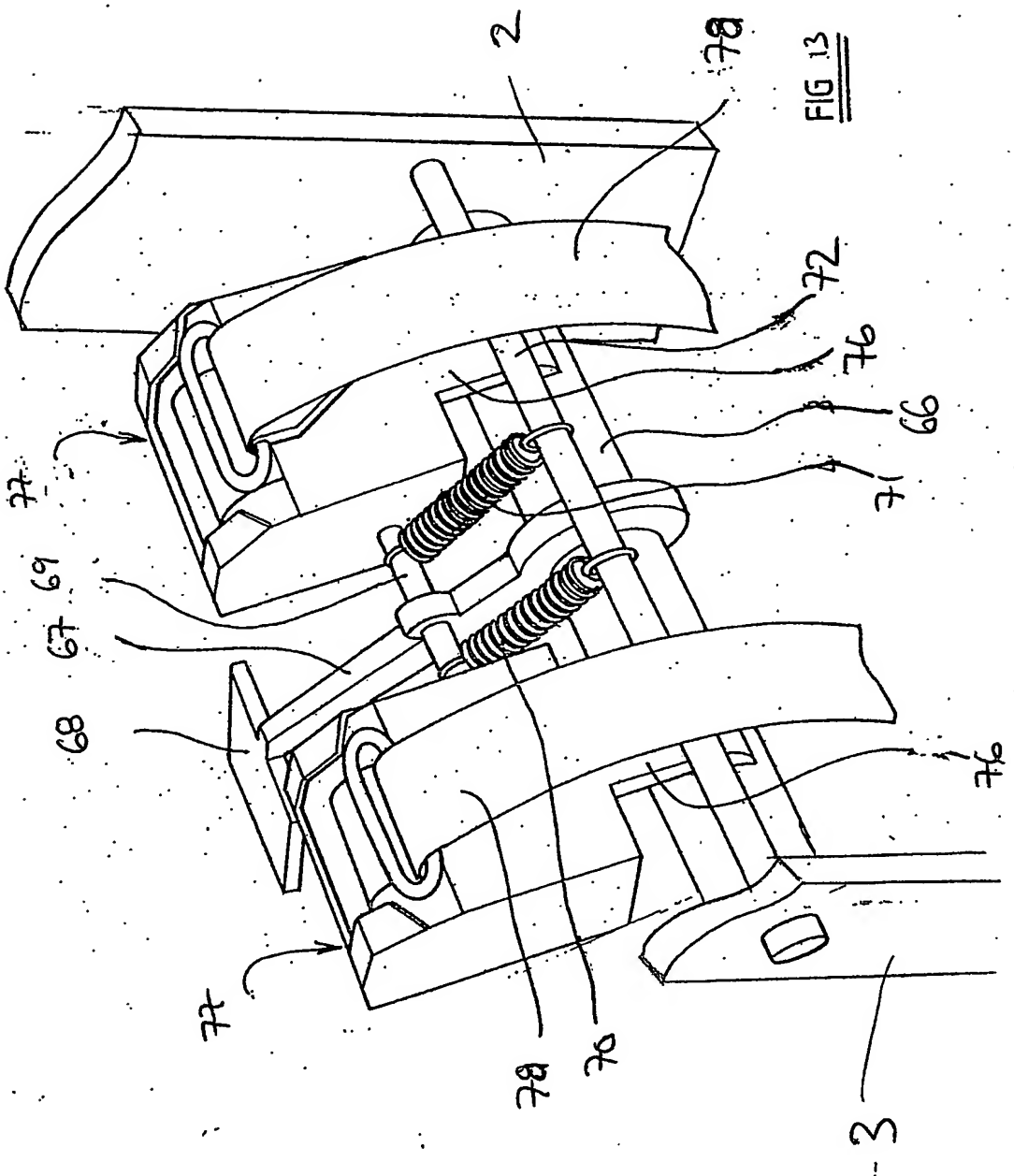


FIG 13

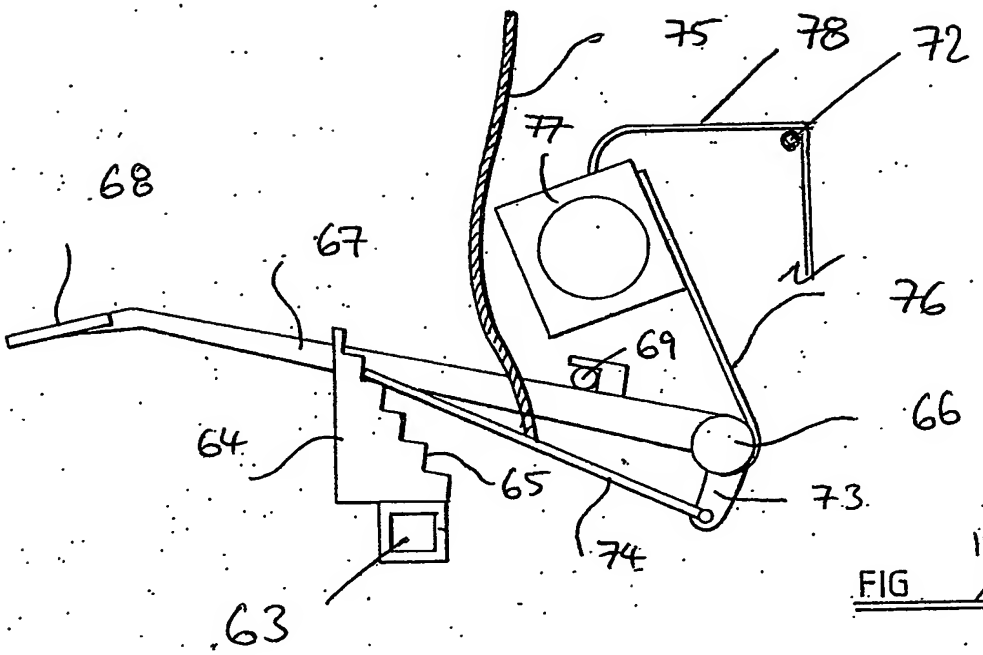

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FIG 14

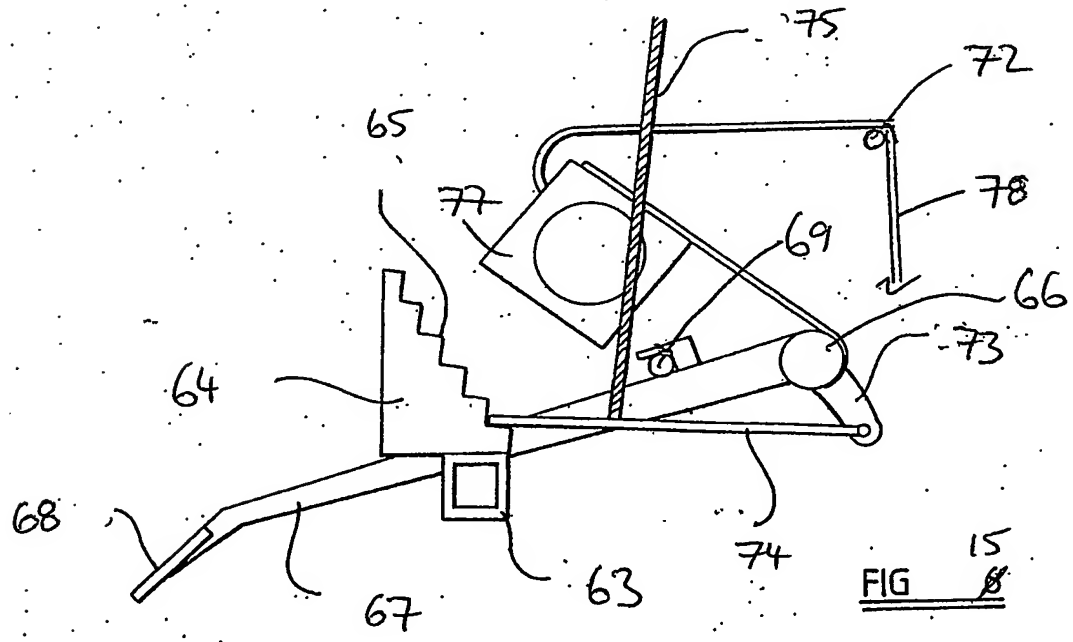
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FIG 15

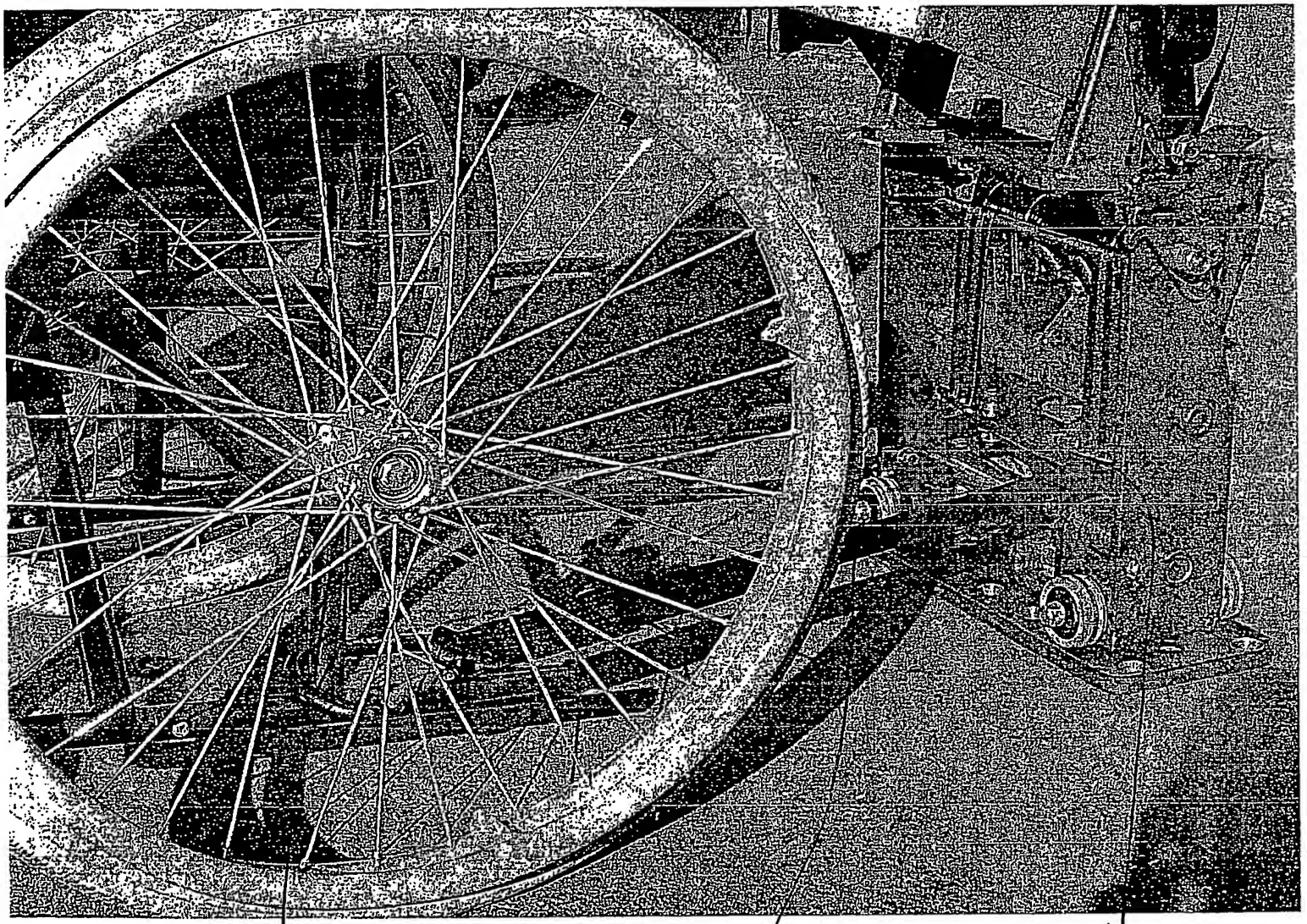

Fig 16/~~15~~

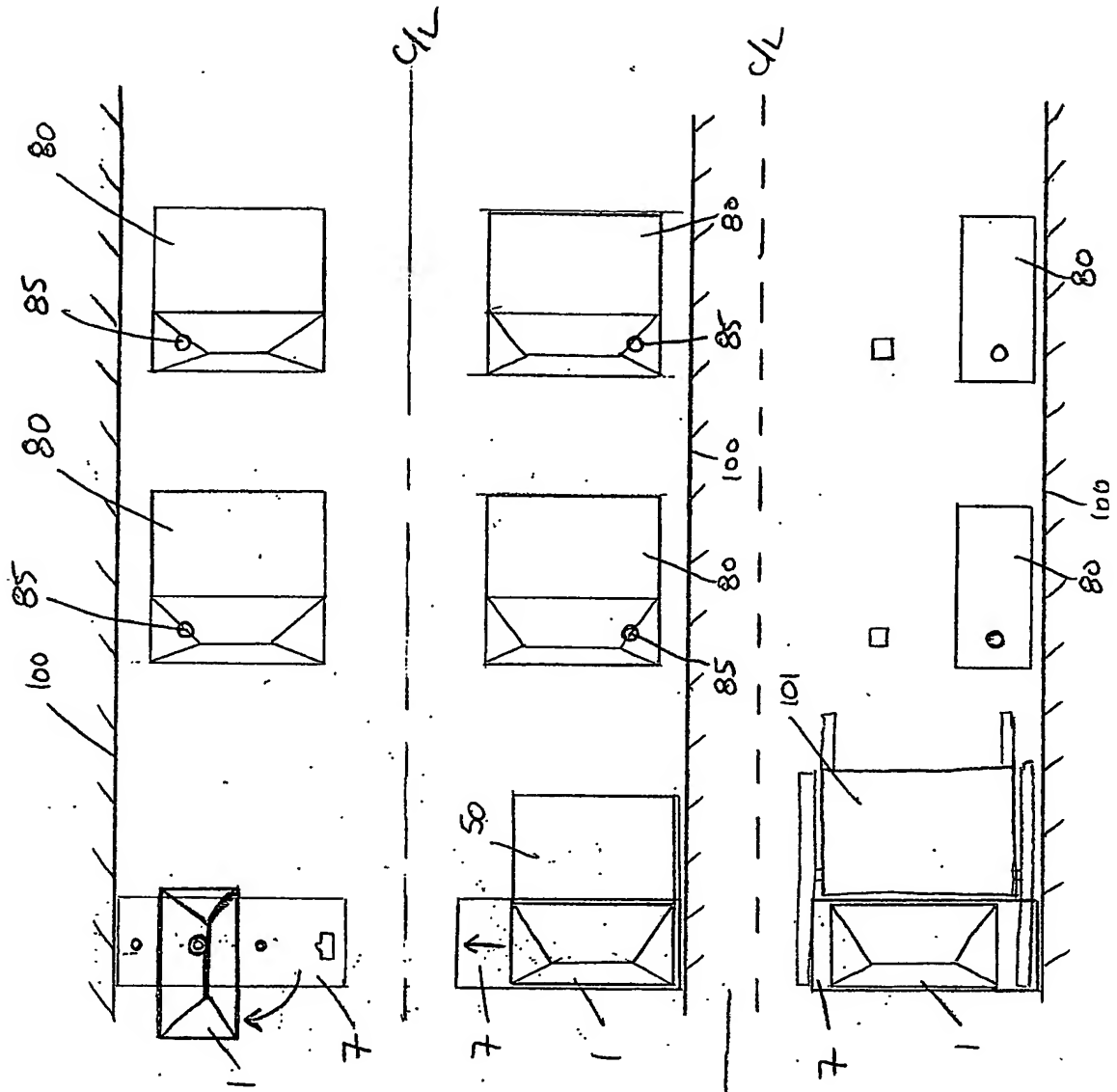

Fig. 18

Fig. 18

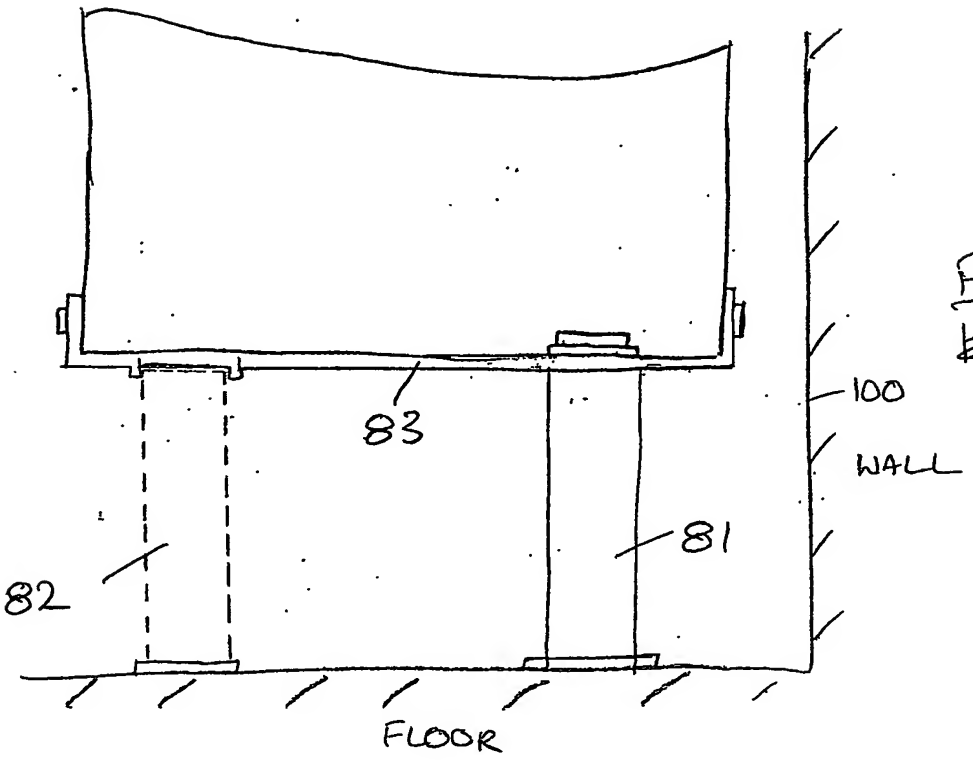

Figure 19

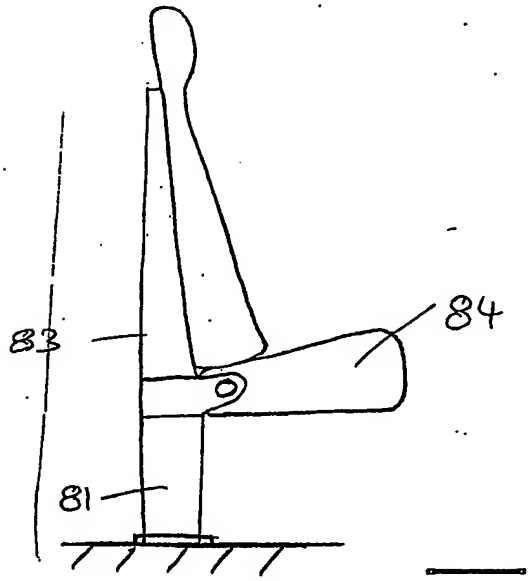

Figure 20

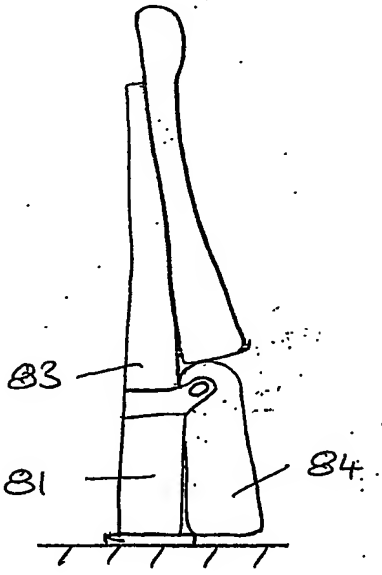

Figure 21

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